Chapter 2. North Coast Hydrologic Region

Setting

The North Coast Region encompasses redwood forests, inland mountain valleys, and the arid Modoc Plateau. The region includes all or large portions of Modoc, Siskiyou, Del Norte, Trinity, Humboldt, Mendocino, Lake, and Sonoma counties (Figure 2-1). It also includes small areas of Shasta, Tehama, Glenn, Colusa, and Marin counties. The region includes the Pacific Ocean coastline from Tomales Bay to the Oregon border, and then extends east along the border to the Goose Lake basin. This region covers roughly 19,500 square miles, or more than 12 percent of the State's land area. Most of the region is mountainous and rugged. The mountain crests, which form the eastern boundary of the region, are about 6,000 feet elevation with a few peaks higher than 8,000 feet. Only 13 percent of the land is classified as valleys or mesas, and more than half of that is in the higher northeastern part of the region in the upper Klamath River Basin.

Climate

Weather conditions and temperatures vary dramatically from the cooler coastal areas to the arid inland valleys in Siskiyou and Modoc counties. In the western coastal portion of this region, average temperatures are moderated by the influence of the Pacific Ocean and range from highs in the mid-80s in the summer to lows in the mid-30s during the winter. In the inland regions of Siskiyou and Modoc counties temperatures are more variable, where summer high temperatures usually reach the 100-degree mark while low temperatures during the winter are often in the low-30-degree range. Heavy rainfall in the coastal mountain ranges makes the North Coast region the most water-abundant area of California, producing about 41 percent of the State's total natural runoff. Average annual precipitation varies from more than 100 inches in the north coast mountains of Del Norte County to less than 15 inches in the Lost River drainage area of Modoc County, and the region wide average is about 51 inches per year. There is relatively little snow in this region, and it usually stays on the ground only a short time at elevations of 4,000 feet or higher. As a result of the abundant rainfall, the average annual runoff for the rivers of this region is about 29 million acre-feet per year, which is the largest volume compared to all other hydrologic regions of California.

Population

The population of the entire North Coast region was about 644,000 in year 2000, which is less than 2 percent of California's total population. More than half of this region's population lives in the southern part, primarily in Santa Rosa and the surrounding communities of Rohnert Park, Windsor and Healdsburg along the Russian River watershed. Urban growth in the Santa Rosa area, 147,500 people in year 2000, is heavily influenced by the overall urban expansion of the adjacent San Francisco Bay region. Other smaller communities in the northern portions of this region include Eureka, 26,000 in 2000; Ukiah, 15,500 in 2000; Arcata, 16,600; Crescent City, 7,300; and Yreka, 7,200 people in 2000.

When compared with the 1990 regional population of 571,750, the current 644,000 represents a growth rate of 12.6 percent in the last 10 years, which is slightly lower that the statewide growth rate of nearly 14 percent over the same period. Projections today indicate that the regional population is expected to grow to about 895,000 by year 2030, which would represent a 39 percent increase from the current year 2000 totals. Figure 2-2 provides a graphical depiction of the North Coast region's total population from year

1960 through year 2000, with current projections to year 2030. More than half of this projected growth is anticipated to occur in the Santa Rosa region, as urban populations from the San Francisco Bay area continue to expand north. Population increases in the rural communities in the northern half of this region are projected to grow more slowly.

Land Use

Forest and rangeland represent about 98 percent of the land area of the region. Much of the region is identified as national forests, state and national parks, land under the jurisdiction of the federal Bureau of Land Management, and large Indian lands such as the Hoopa Valley and Round Mountain reservations. The major land uses in the North Coast Region consist of timber production, agriculture, fish and wildlife management, parks, recreational areas and open space. However, in recent years the timber industry has declined as a result of timber over-cutting, economic issues, and the expansion of environmental regulations.

Vacationers, boaters, anglers, and sightseers are attracted by the region's 400 miles of scenic ocean shoreline, including nearby forests with more than half of California's redwoods. The inland regions are mountainous, and include 10 wilderness areas run by the U.S. Forest Service. More than 40 state parks, numerous Forest Service campgrounds, the Smith River National Recreation Area and the Redwood National Park are all within this hydrologic region. It is an area of rugged natural beauty with some of the most renowned fishing in North America.

Climate, soils, water supply, and remoteness from markets are factors that limit the types of agricultural crops that can be grown in the North Coast region. In the inland valley areas, there is more irrigable land than can be irrigated with existing water. The agricultural trend in the past decade has been one of land consolidation and the loss of prime agricultural land to urban growth. This trend is a result of low crop values, the lack of additional inexpensive surface water, and the ability to use only the most economically developable groundwater.

Irrigated agriculture in the North Coast region uses most of the region's developed water supplies. Irrigation today accounts for about 81 percent of the region's water use, while municipal and industrial use is about 19 percent. About 327,400 acres, or about 2 percent of the region, is irrigated. Of that, 225,900 acres are in the Upper Klamath River basin where the main irrigated crops are pasture and alfalfa, grain, and potatoes. The highest-value crops in the region are the substantial acres of grapes and orchards in the Russian River Basin and ornamental flowers, including bulbs, in Del Norte County.

The total acreage of fruit and nut orchards has decreased over the past several decades. For example, in Sonoma County, orchards declined from 20,000 acres in 1971 to fewer than 3,500 acres in 2001. However, the amount of irrigation water used on orchards did not decrease in the same proportion, because many of the apple, prune and walnut orchards taken out of production were not irrigated. As the acreage of orchards declined, the acreage planted in vineyards increased. Most of the newer vineyards use drip irrigation systems for plant irrigation, but overhead sprinklers are also used for frost protection in the spring and for post-harvest irrigation in the fall.

Many of the region's watersheds support threatened and endangered species of plants and animals, and many North Coast streams and rivers support anadromous fish runs of salmon and steelhead trout. The

principal reaches of the Klamath, Eel, and Smith Rivers have been designated wild and scenic under federal and State law and therefore are protected from additional large-scale water development.

Water Supply and Use

Many of the smaller communities and rural areas in the North Coast region are generally supplied by small local surface and groundwater systems. Larger water supply projects in this region include the U.S. Bureau of Reclamation's Klamath Project, the Army Corps of Engineers' Russian River Project (Lake Mendocino and Lake Sonoma), and the Humboldt Bay Municipal Water District's Ruth Reservoir, which serves coastal communities from Eureka to McKinleyville. Because the Upper Klamath River watershed is in both California and Oregon, the federal Klamath Project includes water supply facilities in both states. Facilities within the California portion include Clear Lake Reservoir for water supply, Tule Lake and Lower Klamath Lake as waterfowl refuges, and Iron Gate Reservoir as a hydroelectric facility of Pacific Power and Light Co. The primary water supply facilities on the Oregon side are Gerber Reservoir and Upper Klamath Lake. The Klamath Project is the largest agricultural irrigation project in the region, and supplies water to about 240,000 acres, of which 62 percent is in Oregon and 38 percent is in California. To maintain adequate instream fishery flows for the lower Klamath River, water releases must be coordinated among the various reservoirs operated by different agencies within both states.

Two of the largest water supply reservoirs in the North Coast region are the U.S. Bureau of Reclamation's 2,437,000 acre-foot Trinity Lake on the Trinity River, and the U.S. Corps of Engineer's 380,000 acre-foot Lake Sonoma in the Russian River watershed. These facilities were primarily designed to store water for export from the North Coast region to the Sacramento Valley and to the northern San Francisco Bay regions. They also make downstream water releases for fishery purposes. Another intrabasin water transfer system that has been in existence since 1921 diverts water from the upper reaches of the Eel River at Lake Pillsbury through a tunnel to Lake Mendocino in the Russian River watershed. The water stored in Lake Mendocino is eventually used to meet urban and agricultural needs in the Russian River region and the Santa Rosa area.

Groundwater development is sporadic throughout the mountainous areas of the region, and wells are generally along the valleys of rivers and streams. As described in DWR's Bulletin 118-03 on *California's Groundwater*, there are very few significant aquifers in the coastal mountains that are capable of providing reliable water. In the coastal areas, most groundwater is developed from shallow wells that are typically installed in the sand and gravel beds that are adjacent to the region's rivers. Significant groundwater basins do exist in the upper Klamath River valley along the border with Oregon, and also in the southern tip of this region underlying the Santa Rosa area.

The principal developed uses of environmental water occur in the Lower Klamath Lake, Tule Lake, and Clear Lake National Wildlife Refuges, and the Butte Valley and Shasta Valley Wildlife Areas. In Butte Valley, most of the water for wildlife comes from about 3,000 acre-feet of groundwater. As a result of the passage of both federal and State wild and scenic rivers acts in 1968 and 1972, many of the major rivers in the North Coast region have been preserved to maintain their free-flowing character and provide for environmental uses. Most of the Eel, Klamath, Trinity and Smith Rivers are designated as wild and scenic, which preserves these river resources and protects them from new water development. On the Trinity River, efforts to restore the fishery led to a federal Record of Decision in year 2000 to increase the fishery flow releases from Trinity Lake. After several years of legal challenges, this decision was upheld by a July 2004 federal court decision. The water allocated to downstream fishery flows is now being

increased from the previous 340,000 acre-feet per year, to a new schedule that ranges between 368,600 acre-feet in a critically dry year up to more than 700,000 acre-feet per year in a wet water year. Biologists and CVP project operators are still working on the development of daily, weekly and monthly water release schedules that will make the best use of these new water allocations.

The water balance tables at the end of this chapter provide a detailed summary of the actual region-wide water supplies and water uses from years 1998, 2000 and 2001 for the entire North Coast region, along with the narrative discussion at the end of this chapter. Figure 2-3 summarizes the dedicated and developed urban, agricultural and environmental water uses in the region for 1998, 2000 and 2001. Figure 2-4 provides a graphical presentation of all of the water supply sources that are used to meet the developed water uses within this hydrologic region for these three years. As shown on the first graph, the volume of water dedicated to wild and scenic rivers, called "statutory required outflows," is the largest component of dedicated water uses in the region. The information presented in Table 2-1 at the end of the chapter also indicates that the volume of water exported to other regions is generally greater than the all the water consumptively used for urban, agriculture and wildlife refuges within the North Coast region.

State of the Region

The North Coast region generally has the most abundant water resources of any region of the State. The high volumes of precipitation and natural river runoff are a key component for most of the beneficial uses of its water bodies, including commercial and recreational fishing, shellfish harvesting, urban and agricultural use, and recreation. Many of the region's forests and watersheds support threatened and endangered species of plants and animals, and the major rivers and streams contain significant anadromous fishery resources. This region also features important coastal resources, including Bodega Harbor and Humboldt Bay, and many small estuaries.

Challenges

The region nonetheless is confronted by many water quality and water supply challenges. The North Coast Regional Water Quality Control Board's water quality priorities highlight the need for control of nonpoint source runoff from logging, rural roads, agriculture (including grazing), and urban areas. In fact, sediment, temperature, and nutrients are the primary focus of the RWQCB's 303(d) list of impaired water bodies. Along the coast, nonpoint-source pollution can cause microbial contamination of shellfish growing areas, especially oysters. Much of the region is characterized generally by rugged, steep, forested lands, with highly erodable, loosely consolidated soils; taken together with wildfires, extensive timber harvesting, and heavy precipitation primarily in the form of rain, the watershed is highly susceptible to erosion and landslides. Such heavy runoff in turn causes stream sedimentation that impacts habitat for spawning and rearing of anadromous fish. Channel modifications and water diversions have radically changed water-quality conditions in many water bodies in the region, reducing natural flows that dilute contaminant concentrations and lessen their impacts. In the southern portion of the region, the development of new hillside vineyards is an increasing source of erosion and pesticides.

Fisheries can be adversely affected by a number of water quality factors. The Eel, Mad, Trinity, Klamath and Russian rivers, as well as many other streams, suffer from sedimentation, which can smother salmonid spawning areas. The North Coast region's basin plan sets turbidity restrictions to control erosion impacts from logging and related activities, such as road building. Timber harvests can also decrease the canopy shading rivers and streams, thereby increasing water temperatures to levels that are detrimental to cold water fisheries. The basin plan also specifically establishes temperature objectives for the Trinity

River, in which reduced flows have disrupted temperature and physical cues for anadromous fish runs. Because of water diversions, summer temperatures in the Trinity as well as the Klamath can be lethal to salmonids. Fisheries can be further adversely affected by the lack of woody debris for pool habitat and sediment metering.

The North Coast RWQCB's basin plan requires tertiary treatment of wastewater discharges to the Russian River, a major source of domestic water, and establishes limits on bacteriological contamination of shellfish-growing areas along the coast. The plan also prohibits or strictly limits waste discharges to the Klamath, Trinity, Smith, Mad, and Eel rivers, as well as estuaries and other coastal waters. Nonpoint source runoff, especially after heavy precipitation, has resulted in contamination and closure of shellfish harvesting beds in Humboldt Bay. In the lower Russian River watershed stormwater runoff also might be contributing to high ammonia and low dissolved oxygen levels in Laguna de Santa Rosa, which is threatening aquatic life. Mercury in fish tissue is a water quality concern in Lakes Pillsbury, Mendocino, and Sonoma; a health advisory for mercury has been issued for Lake Pillsbury.

Groundwater quality problems in the North Coast region include contamination from seawater intrusion and nitrates in shallow coastal groundwater aquifers; high total dissolved solids (TDS) and alkalinity in groundwater associated with the lake sediments of the Modoc Plateau basins; and iron, boron, and manganese in the inland groundwater basins of Mendocino and Sonoma counties. Septic tank failures in western Sonoma County, at Monte Rio and Camp Meeker, and along the Trinity below Lewiston Dam, are a concern because of potential impacts to groundwater wells and recreational water quality.

Other water quality concerns include the impacts of fuel constituents such as MTBE to recreational water use at Trinity, Lewiston, and Ruth lakes. Abandoned mines, forest herbicide application and historical discharge of wood treatment chemicals at lumber mills, including Sierra Pacific Industries near Arcata and Trinity River Lumber Co. in Weaverville, also are regional issues of concern. Of note, according to the 305(b) report, only the Russian River basin has a long-term water quality data set in this region, which is necessary to evaluate quality changes over time.

Even though the North Coast region produces a substantial share of California's surface water runoff, about 10 percent of this runoff occurs in the summer and water supplies are limited throughout much of the area. Small surface-water supply projects generally have limited carryover capacity that cannot supply adequate water during extended months of low rainfall. The drinking water for many of the communities on the North Coast, such as Klamath, Smith River, Crescent City, and most of the Humboldt Bay area, is supplied by Ranney collectors (horizontal wells adjacent to or under the bed of a stream). Erosion is undercutting some of these collectors, such as those in the Mad River supplying the Humboldt Bay Municipal Water District (which serves Eureka, Arcata, and McKinleyville). As such, these "wells" may actually be under the direct influence of surface water, which would then require filtration. The city of Willits has had chronic problems with turbidity, taste, and odor with water from Morris Reservoir, and high arsenic, iron, and manganese levels in its well supply. Organic chemical contamination has closed municipal wells in the cities of Sebastopol and Santa Rosa. The town of Mendocino typifies the problems related to groundwater development in the shallow marine terrace aquifers; surveys in the mid-1980s indicate about 10 percent of wells go dry every year and up to 40 percent go dry during droughts.

The Klamath River Basin is an interstate watershed with surface storage facilities in both California and Oregon, and competing water needs for agriculture, Indian tribal rights, waterfowl refuges, and

endangered fish. The primary water storage facilities belong to the federal Klamath Project, which is operated by the U.S. Bureau of Reclamation, in conjunction with other dams and diversion structures operated by local irrigation districts, wildlife management agencies, and electric power companies. In 2001, the lack of rainfall generated a severe drought, which aggravated water disputes and caused harsh effects to agriculture, waterfowl refuges and the downstream fisheries. The endangered fish populations include listed species such as the Lost River and shortnose suckers, Coho salmon, and steelhead trout. During 2001, the USBR was able to deliver only about 75,000 acre-feet of water to agriculture in California, which is about 25 percent of normal. In the Tule Lake and Lower Klamath Lake sub-basins, this translated to a drought disaster for both agriculture and the wildlife refuges. In 2002, about 33,000 adult salmon died trying to swim up the Klamath due to water quality problems.

Federal agencies have taken a lead role in conducting studies and developing proposals to resolve the competing water needs in the Klamath basin, with assistance from state agencies in Oregon and California, and several local governments and interest groups. The USBR is developing a new Klamath Project Operations Plan intended to establish specific allocation procedures to best meet the needs of agriculture, fishery restoration per the Endangered Species Act, waterfowl refuges, and Tribal water rights. The U.S. Geological Survey has initiated a four phase Klamath Basin groundwater study to document water levels, water quality, and groundwater flow patterns; and to identify potential opportunities for future groundwater conjunctive use. The U.S. Natural Resources Conservation Service has developed an adaptive management program that allocates federal funds for agricultural conservation programs, fish and wildlife habitat, water quality improvements, and water storage improvements; which are intended to increase water use efficiencies and achieve long-term reductions in total water use. Other federal agencies in the Klamath Basin Working Group include the U.S. Forest Service, the Fish and Wildlife Service, the Bureau of Land Management, and the National Marine Fisheries Service. Many of these programs and studies will take several years to develop and implement, so the overall ability to successfully meet all competing water needs will not be known for several years. In the meantime, below-normal water supply conditions during the past three years continue to aggravate the water management issues, disputes and negative effects to basin resources.

As part of the efforts to restore the Trinity River fishery, the Secretary of the Interior in December 2000 approved a significant change in use of Trinity River Basin water. As part of an effort to restore Trinity River fish habitat, the river's instream flows were increased from 340,000 acre-feet per year (roughly 25 percent of average annual flow at the CVP diversion point on the Trinity River) to an average of 595,000 acre-feet per year. This decision, which would reduce the amount of water available for export from the Trinity River to the Central Valley, was challenged by water and power interests in U.S. District Court in 2001. On July 13, 2004, the 9th U.S. Circuit Court of Appeals overturned the injunction imposed by the District Court, and ruled that the original year 2000 Record of Decision was adequate. The water allocated to downstream fish flows is now being increased to the new flow schedule, which ranges from a minimum of 368,600 acre-feet in a critically dry year up to 815,000 acre-feet in an extremely wet year.

The Eel River and its tributaries are the largest river system draining to the coast of Humboldt County, and it is characterized by significant water quality problems during winter storm events due to massive sediment loads from unstable soils. The Eel River is also host to Humboldt County's largest fisheries of salmon and steelhead, which depend on access to upstream tributaries for spawning. The only major water storage in the upper reaches of the Eel River is the Potter Valley Project, which consists of Lake Pillsbury and a downstream diversion dam and tunnel to the Russian River. This project was built by

Pacific Gas & Electric Co. in 1921 for hydropower and to export water from the Eel River to the Russian River for municipal water supply. However, in recent years fishery interest groups have argued that the amount of water diverted to the Russian River has adversely affect salmon and steelhead in the Eel River. The water needs of the Eel River fishery have been evaluated and disputed during the recent Federal Energy Regulatory Commission hydropower relicensing of the Potter Valley Project. In June 2004, FERC approved PG &E's relicensing of the Potter Valley Project and its associated water diversions to the Russian River. However, fishery groups are litigating the FERC decision, so the future distribution of project water between the Eel and Russian Rivers is not yet resolved.

Accomplishments

In early 1998, the city of Santa Rosa selected an alternative plan to recharge depleted geothermal fields in the Geysers area with treated wastewater as part of its long-term wastewater-recycling program. Under this alternative, the Santa Rosa Subregional Sewage System will pump about 11 million gallons per day of treated wastewater to the Geysers for injection into the steam fields. This amount is a little less than half the flow the treatment system is expected to produce when finished. The project is intended to eliminate weather related problems of the city's disposal system and minimize treated wastewater discharges into the Russian River.

The communities around Humboldt Bay support programs intended to achieve the dual goals of flood control and habitat enhancement. The region is committed to restoring the natural functioning of urban streams and wetlands. The city of Arcata has many programs to acquire conservation easements and deeds to wetlands, for the re-establishment of a natural flood plain for storm water management, and for the restoration of fish and wildlife habitat. In the past 10 years, Arcata has collaborated with government agencies, non-profit organizations, community groups and schools for development of these restoration activities, and has spent millions of dollars on programs. Additional financial support has been obtained through grants from DWR, DFG, the Wildlife Conservation Board, and the U. S. Fish and Wildlife Service.

The Russian River Action Plan, first prepared in 1997, was updated by Sonoma County Water Agency in 2003, and provides a regional assessment of ongoing efforts to restore the salmonid fishery and improve the riparian habitat in the Russian River watershed. Seventeen current and pending restoration activities are described, followed by an extensive list of additional habitat restoration projects that are in need of funding. In 1997, NMFS listed steelhead trout as threatened and in 2002 listed Coho salmon as endangered along part of the Central California coast that includes the Russian River Basin. SCWA, USACE, and NMFS signed an agreement to establish a framework for consultation under Section 7 of the Endangered Species Act. Under that agreement USACE and SCWA jointly review and coordinate information on their respective Russian River activities to determine effects to critical salmonid habitat. The Eel-Russian River Commission, composed of county supervisors from Humboldt, Mendocino, and Sonoma Counties, also provides a regional forum for agencies and groups to stay informed about projects and issues affecting the Eel and Russian Rivers.

Relationship with Other Regions

As shown on the regional map (Figure 2-1) the Klamath River basin straddles the border with Oregon, so water from the upper basin flows into Oregon and eventually returns to California above Iron Gate Reservoir. This hydrologic region also receives a small amount of imported water (about 2,000 acre-feet per year) from the upper reaches of the Sacramento River Hydrologic Region through a canal called the

North Fork Ditch. The North Coast region exports a large volume of water from the upper reaches of the Trinity River into the Sacramento River region through the USBR's Central Valley Project at Lewiston Dam and the Clear Creek Tunnel. For 1998, 2000 and 2001, the Trinity River exports were 851 thousand acre-feet per year, 1.11 million acre-feet per year and 669 thousand acre-feet per year, respectively. In future years these Trinity River exports are likely to be reduced due to the increased instream flows established for the Trinity River fishery. Elsewhere, a smaller regional export of roughly 33,000 acre-feet per year is transported from the lower Russian River into the northern portion of the San Francisco Bay region through the Sonoma County Water Agency.

Looking to the Future

When compared to the more developed regions of the State, urban and agricultural water use in the North Coast region use a relatively small part of the total available water. However, localized water supply problems are expected to continue for communities with limited surface water and groundwater, particularly during extended droughts. While significant water supplies exist throughout most of the North Coast region, the ability to acquire funding to upgrade and expand water systems is a major problem for the rural communities.

Along the coast, the Humboldt Bay Municipal Water District system might expand to serve the Trinidad-Moonstone area, which is experiencing local water deficiencies. The Eureka-Arcata area may undergo construction of a regional water treatment plant and is investigating groundwater development as an alternative source, which would not require the same level of water treatment.

Crescent City has an adequate supply from the Smith River but needs to increase system transmission and storage capacity and might build a new water treatment facility. The city of Rio Dell might also begin construction of a surface water treatment facility. Ranney wells will be installed in the Eel River as a primary water supply for Rio Dell. Trinity County Waterworks District No. 1, which serves the town of Hayfork from the 800-AF Ewing Reservoir, has plans to enlarge the reservoir and expand its surface water system.

In the Klamath River basin, the USBR is leading efforts to balance water needs between the historic agricultural uses of the Klamath Project, the instream needs of endangered fish, as well as other system water uses. The recent dry hydrologic conditions have intensified these issues, and federal funding was approved in 2002 to provide relief through the development of conservation programs and the availability of new groundwater. The USBR is continuing to update the Klamath Project long-term operations plan, but difficult issues have delayed its completion. The Klamath River Compact Commission also provides a forum for discussions on management of interstate water resources between Oregon, California, and the federal agencies, and promotes intergovernmental cooperation on water allocation issues. A few additional groundwater wells are likely to be constructed to augment irrigation supplies in the Butte Valley and Tule Lake areas. Pressure for additional groundwater development in areas like Scott and Shasta Valleys will be greater since the 2002 listing of the Coho salmon. The new listing, along with stricter applications of California Department of Fish and Game instream regulations, will reduce the supplies available for irrigation from existing water developments and from natural runoff.

The lower Russian River watershed and the adjoining Santa Rosa area are projected to experience the most significant urban growth for any part of the North Coast Hydrologic Region. This growth will continue to stress the available water and accentuate the need balance urban water uses with

environmental water needs. The Sonoma County Water Agency has a central role in maximizing the use of existing water supplies, and is actively developing conservation, water recycling and groundwater conjunctive use. The Sonoma County Water Agency is also restoring and preserving the Russian River fishery and habitat, and is the lead agency for developing and implementing a Russian River Action Plan.

Restoration and protection of salmonid habitat will continue to be a prominent fishery issue for all of the major coastal rivers. The federal listing of Coho salmon and steelhead under the Endangered Species Act generates additional regulatory requirements that affect all surface water uses on these rivers. Existing and planned water projects will need to be operated in ways that do not affect the fishery, which might alter methods and schedules for water diversions, hydropower operations, and waste water discharges. Surface water quality issues such as sediment loads, nutrients, and warm water can also affect the fishery, and these fall under the jurisdiction of the North Coast Regional Water Quality Control Board, which is developing basin plans to address water quality problems and protect the coastal rivers.

Regional Planning

The forum and focus of regional planning activities varies significantly from north to south across the North Coast region, due to the diversity of water issues and the involved water agencies. In the far north interstate Klamath River watershed, much of the planning is being done by federal agencies such as the U.S. Bureau of Reclamation, the Natural Resources Conservation Service, and the U.S. Fish & Wildlife Service, among others. These federal agencies are working to balance the needs of the federal Klamath Project with water for fish, tribal interests, and interests of communities affected by the federal project. Planning and issue resolution for the Trinity River also have a significant federal lead role, because of the federal CVP at Trinity and Lewiston lakes. In general, many of the Northern California counties lack funding to conduct regional planning at the level of funding available to the federal agencies.

In the central portion of the region, the communities and water issues in Humboldt, Trinity and Mendocino counties tend to be organized at the local or county levels, partly because these areas are geographically separated from other developed regions. Planning activities of Humboldt Bay Municipal Water District and the Humboldt County general plan update are one of the primary forums for regional planning for the Arcata and Eureka areas. The Mendocino Council of Governments and the Mendocino Community Services District are among the lead water planning agencies for the county, which includes Ukiah and portions of the upper Russian River wine country.

Sonoma County is the southernmost county in the North Coast Hydrologic Region, and water planning is closely associated with those of the adjoining San Francisco Bay region. Water planning is strongly focused toward meeting the urban needs of Santa Rosa and the surrounding communities served by Sonoma County Water Agency. The agency coordinates with and is a member of several San Francisco Bay area regional planning groups, such as the Bay Area Water Agencies Coalition that provides significant direction and guidance for regional planning. Much of Sonoma County regional planning also focuses on the competing uses of the Russian River, which is the largest river in this part of the North Coast region. The Russian River Action plan has been updated by Sonoma County Water Agency, as a coordinated effort among federal, state and local agencies to protect and restore salmonid fishery populations and habitat.

The State agency with the most significant influence on regional water planning activities in the North Coast region is the North Coast Regional Water Quality Control Board. Although headquartered in Santa

Rosa, this agency has key responsibilities for surface water quality and regulations for all of the rivers in the region. The NCRWQCB oversees several water quality programs and issues related to timber operations, vineyard runoff, non point source pollution, the development of Total Maximum Daily Load limits, and the development of water quality objectives for individual basin plans.

Water Portfolios for Water Years 1998, 2000 and 2001

The following tables present actual information about the water supplies and uses for the North Coast Hydrologic Region for the three selected years. Water year 1998 was a wet year for this region, with annual precipitation at 154 percent of normal, while the statewide annual precipitation was 171 percent of average. Year 2000 represents normal hydrologic conditions with annual precipitation at 98 percent of average for the North Coast region, and year 2001 reflected dryer water year conditions with annual precipitation at 60 percent of average. For comparison, statewide average precipitation in year 2001 was 72 percent of normal.

Table 2-1 provides more detailed information about the total water supplies available to this region for these three years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. As shown in this table, the largest component of overall water use for this region is by evapotranspiration from the forest lands (native vegetation). The second largest component of water use consists of the river flows into the ocean from designated wild and scenic rivers (labeled as “statutory outflow to salt sinks”). The North Coast region has the highest total volume of water that is used by natural forests and the river outflows, compared to any of the other regions of California. Table 2-1 also indicates that water exports to other regions are generally greater than the volume of water that is consumed for agricultural and urban purposes within this region. Water Portfolio Table 2-2 and the three companion Water Portfolio flow diagrams (Figures 2-5, 2-6 and 2-7) provided more detailed information about how these available water supplies are distributed and used on a region-wide basis.

A more detailed tabulation of the portion of the total available water that is dedicated to urban, agricultural and environmental purposes is presented in Table 2-3. Because most of the North Coast region is largely undeveloped, dedicated environmental water uses for wild and scenic rivers are a larger component of the total dedicated water uses in this region. Less than 10 percent of the dedicated water is used for urban and agricultural purposes within this region. The section at the bottom of Table 2-3 also provides detailed information about the sources of the dedicated water supplies, which are primarily from surface water. Although groundwater is an important source of supply for many small, rural communities, the total amount of groundwater used in the region is small compared to surface water use.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- Del Norte, Mendocino, and Siskiyou counties
- Mendocino County Russian River Flood Control and Water Conservation Improvement District

Figure 2-1
North Coast Hydrologic Region

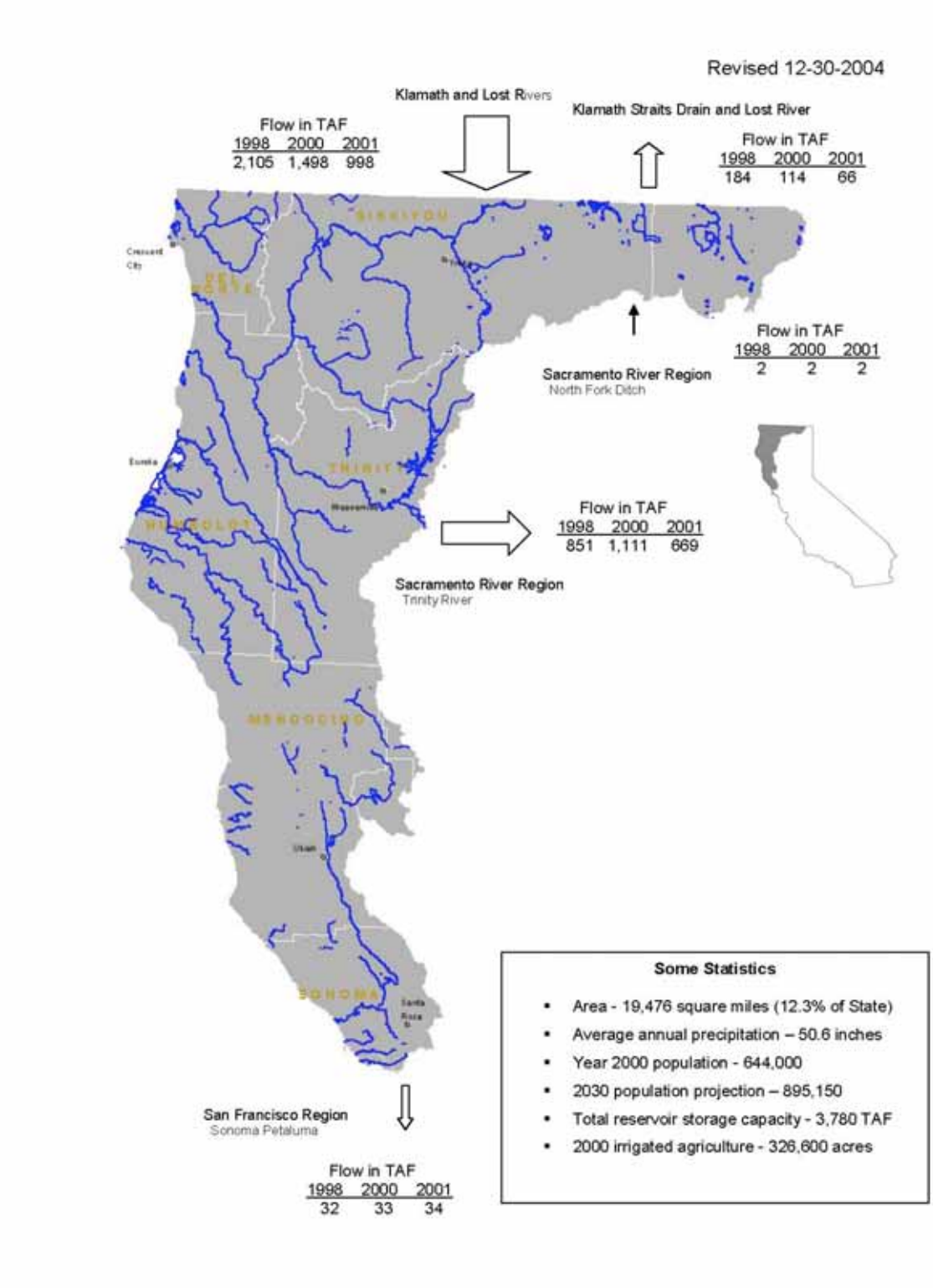

Figure 2-2
North Coast Hydrologic Region Population

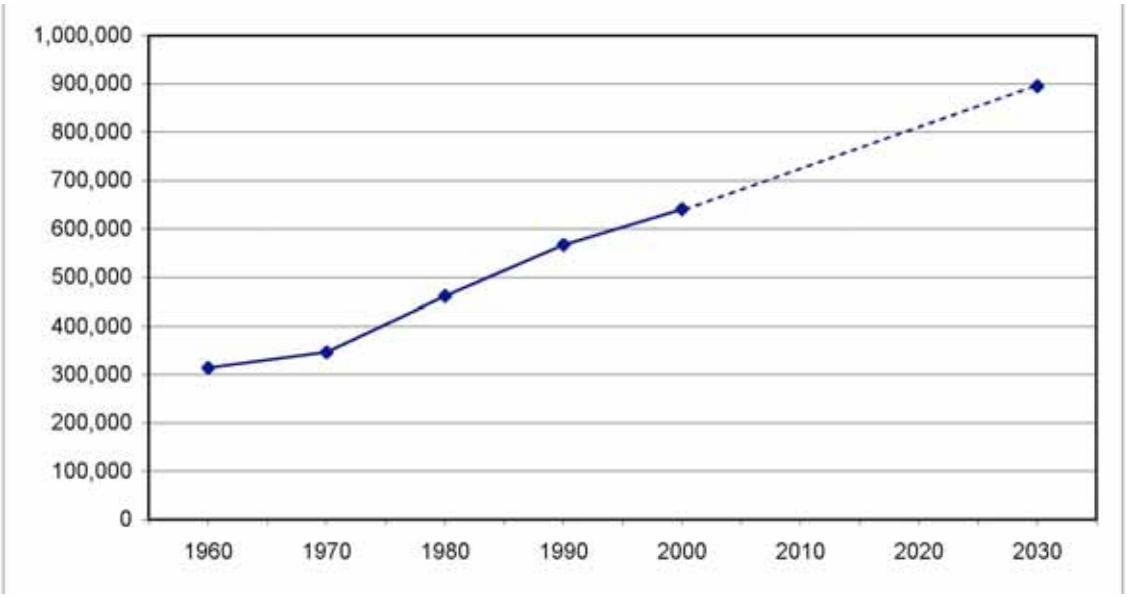

Figure 2-3
North Coast Region Applied Water Uses For Water Years 1998, 2000, 2001

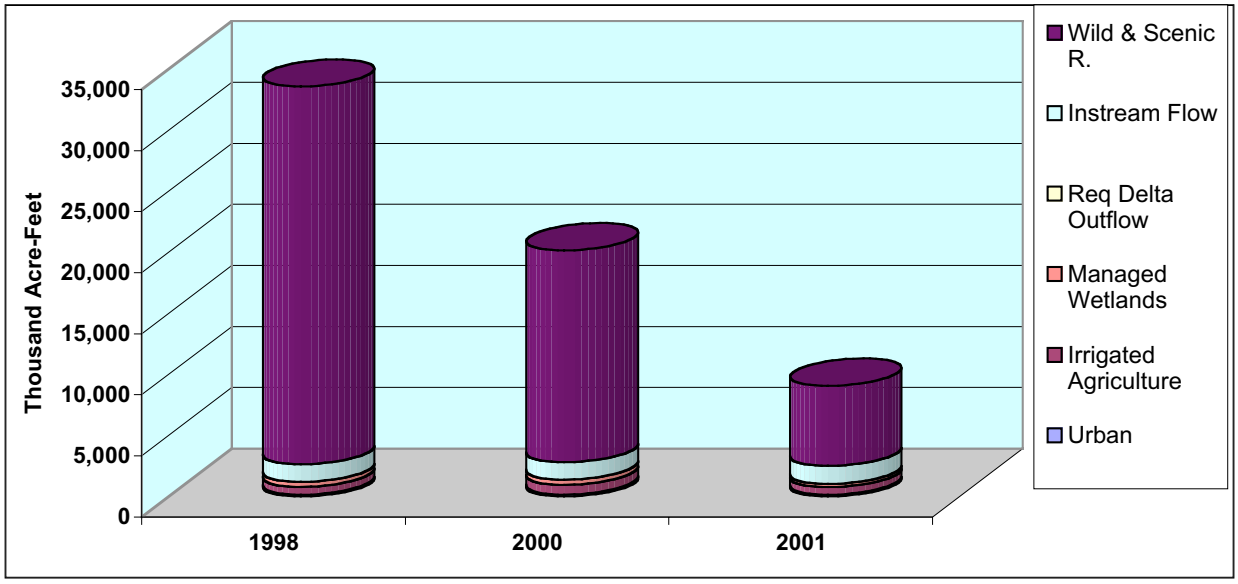

Figure 2-4
North Coast Region Dedicated Water Supplies For Water Years 1998, 2000, 2001

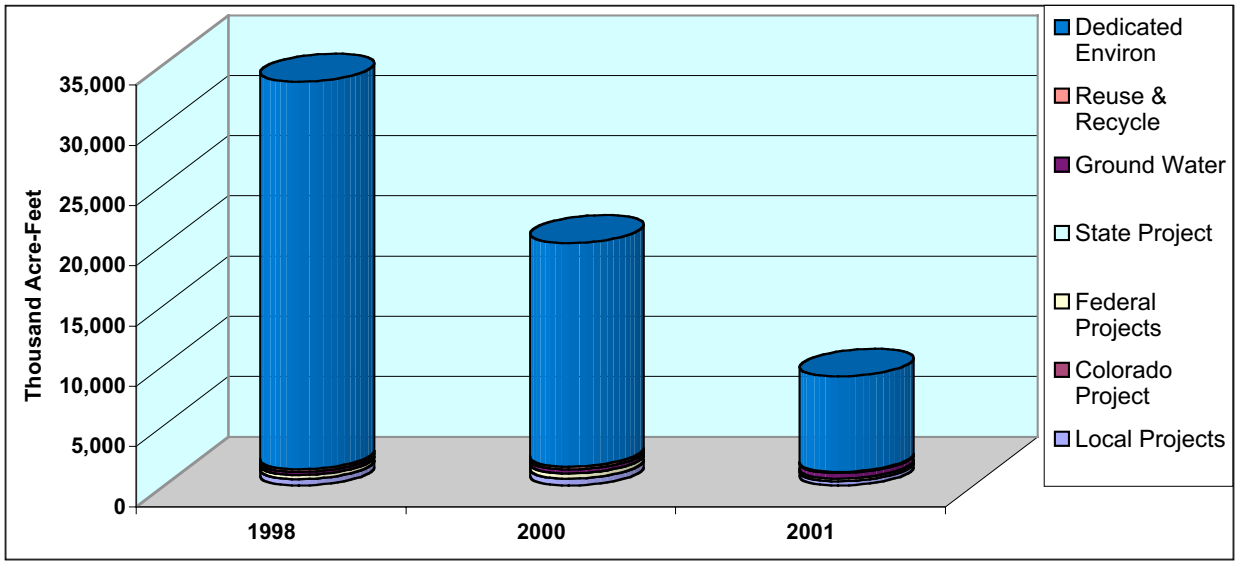

Table 2-1
North Coast Hydrologic Region Water Balance Summary – TAF

Water Entering the Region - Water Leaving the Region = Storage Changes in Region

	Water Year (Percent of Normal Precipitation)		
	1998 (154%)	2000 (98%)	2001 (60%)
Water Entering the Region			
Precipitation	79,216	50,755	31,254
Inflow from Oregon	2,105	1,498	988
Inflow from Colorado River	0	0	0
Imports from Other Regions	2	2	2
Total	**81,323**	**52,255**	**32,244**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	646	791	647
Outflow to Oregon	109	114	66
Exports to Other Regions	863	1,111	669
Statutory Required Outflow to Salt Sink	32,348	18,763	8,021
Additional Outflow to Salt Sink	115	125	122
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	46,586	31,625	23,357
Total	**80,667**	**52,529**	**32,882**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	703	-246	-491
Change in Groundwater Storage **	-47	-28	-147
Total	**656**	**-274**	**-638**

Applied Water * (compare with Consumptive Use)	1,166	1,353	1,018

* Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

****Footnote for change in Groundwater Storage**

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 2-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	North Coast 1998 (TAF)				North Coast 2000 (TAF)				North Coast 2001 (TAF)				Data
Inputs:		Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	**Detail**
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		2,104.5				1,498.0				988.0			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	79,216.3				50,755.1				31,254.4				REGION
6a	Runoff - Natural	53,812.0				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		537.9				592.7				340.6			PSA/DAU
10	Local Imports		2.0				3.1				17.8			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		-				-				-			PSA/DAU
12	Other Federal Deliveries		334.5				408.7				238.2			PSA/DAU
13	State Water Project Deliveries		-				-				-			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow Applied Water		1,445.3				1,444.5				1,473.5			REGION
16	Environmental Water Account Releases		N/A				N/A				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetland		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		5.3				6.4				4.9			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		11.7				11.7				11.7			PSA/DAU
b	Recycled Water - Urban		0.3				0.3				0.4			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		6.0				6.9				7.1			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		-				-				-			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		46.9				61.2				72.2			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		1.2				1.3				0.7			PSA/DAU
c	Deep Percolation of Applied Water - Urban		18.7				19.7				18.5			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		67.5				86.1				23.5			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		143.3				115.5				30.3			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	2,236.3				2,740.7				2,495.0				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	264.3				334.9				452.7				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	2,938.8				2,495.0				2,003.9				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				38.9				45.2				42.4	REGION
b	Evaporation from Reservoirs				167.5				181.3				162.7	REGION
36	Ag Effective Precipitation on Irrigated Lands		271.1				183.2				144.3			REGION
37	Agricultural Water Use		634.6	520.2	514.2		778.9	631.6	624.7		614.6	518.9	511.8	PSA/DAU
38	Managed Wetlands Water Use		391.4	267.1	267.1		424.4	310.2	310.2		254.3	223.3	223.3	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		29.4				30.4				29.1			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		35.2				40.8				40.9			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		13.3				13.7				14.2			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		3.7				3.8				3.9			PSA/DAU
40	Urban Commercial Use		17.1				17.2				17.5			PSA/DAU
41	Urban Industrial Use		30.2				31.7				31.1			PSA/DAU
42	Urban Large Landscape		11.0				12.4				12.7			PSA/DAU
43	Urban Energy Production		-				-				-			PSA/DAU
44	Instream Flow		1,445.3	1,425.1	1,425.1		1,444.5	1,441.9	1,441.9		1,473.5	1,473.5	1,473.5	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild and Scenic Rivers		30,923.0	30,923.0	30,923.0		17,321.1	17,321.1	17,321.1		6,547.6	6,547.6	6,547.6	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				449.2				551.1				444.1	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				155.7				194.4				155.3	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				41.2				45.9				47.7	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				0.2				0.2				0.2	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				29.6				33.5				26.4	PSA/DAU
50	Urban Waste Water Produced	75.8				79.8				78.6				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				-				-				-	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				6.9				7.1				4.2	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				0.4				0.4				0.1	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				37.4				42.1				41.3	PSA/DAU
b	Return Flows to Salt Sink - Urban				76.3				80.8				79.5	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				1.7				1.7				1.5	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				32,348.1				18,763.0				8,021.1	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				109.3				113.7				66.4	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	2.0				2.0				2.0				REGION
56	Regional Exports	863.4				1,110.5				668.5				REGION
59	Groundwater Net Change in Storage	-46.9				-28.4				-146.8				REGION
60	Surface Water Net Change in Storage	702.5				-245.7				-491.1				REGION
61	Surface Water Total Available Storage	3,779.9				3,779.9				3,779.9				REGION

Colored spaces are where data belongs. N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 2-3
North Coast Hydrologic Region Water Use and Distribution of Dedicated Supplies - TAF

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	11.0			12.4			12.7		
Commercial	17.1			17.2			17.5		
Industrial	30.2			31.7			31.1		
Energy Production	0.0			0.0			0.0		
Residential - Interior	42.7			44.1			43.3		
Residential - Exterior	38.9			44.6			44.8		
Evapotranspiration of Applied Water		41.2	41.2		45.9	45.9		47.7	47.7
Irrecoverable Losses		0.2	0.2		0.2	0.2		0.2	0.2
Outflow		76.3	76.3		80.8	80.8		79.5	79.5
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**139.9**	**117.7**	**117.7**	**150.0**	**126.9**	**126.9**	**149.4**	**127.4**	**127.4**
Agriculture									
On-Farm Applied Water	634.6			778.9			614.6		
Evapotranspiration of Applied Water		449.2	449.2		551.1	551.1		444.1	444.1
Irrecoverable Losses		29.6	29.6		33.5	33.5		26.4	26.4
Outflow		41.4	35.4		47.0	40.1		48.4	41.3
Conveyance Losses - Applied Water	24.0			27.5			17.9		
Conveyance Losses - Evaporation		6.9	6.9		7.1	7.1		4.2	4.2
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		2.0	2.0		2.0	2.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**658.6**	**529.1**	**523.1**	**806.4**	**640.7**	**633.8**	**632.5**	**523.1**	**516.0**
Environmental									
Instream									
Applied Water	1,445.3			1,444.5			1,473.5		
Outflow		1,425.1	1,425.1		1,441.9	1,441.9		1,473.5	1,473.5
Wild & Scenic									
Applied Water	30,923.0			17,321.1			6,547.6		
Outflow		30,923.0	30,923.0		17,321.1	17,321.1		6,547.6	6,547.6
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	391.4			424.4			254.3		
Evapotranspiration of Applied Water		155.7	155.7		194.4	194.4		155.3	155.3
Irrecoverable Losses		0.4	0.4		0.4	0.4		0.1	0.1
Outflow		111.0	111.0		115.4	115.4		67.9	67.9
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	391.4	267.1	267.1	424.4	310.2	310.2	254.3	223.3	223.3
Total Environmental Use	**32,759.7**	**32,615.2**	**32,615.2**	**19,190.0**	**19,073.2**	**19,073.2**	**8,275.4**	**8,244.4**	**8,244.4**
TOTAL USE AND LOSSES	**33,558.2**	**33,262.0**	**33,256.0**	**20,146.4**	**19,840.8**	**19,833.9**	**9,057.3**	**8,894.9**	**8,887.8**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	537.9	537.9	534.2	592.7	592.7	588.6	340.6	340.6	336.5
Local Imported Deliveries	2.0	2.0	2.0	3.1	3.1	3.1	17.8	17.8	17.6
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Federal Deliveries	334.5	334.5	332.2	408.7	408.7	405.9	238.2	238.2	235.4
SWP Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Required Environmental Instream Flow	32,187.9	32,187.9	32,187.9	18,583.6	18,583.6	18,583.6	7,933.7	7,933.7	7,933.7
Groundwater									
Net Withdrawal	187.7	187.7	187.7	240.7	240.7	240.7	352.5	352.5	352.5
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	76.6			94.2			100.2		
Reuse/Recycle									
Reuse Surface Water	219.6			211.4			62.2		
Recycled Water	12.0	12.0	12.0	12.0	12.0	12.0	12.1	12.1	12.1
TOTAL SUPPLIES	**33,558.2**	**33,262.0**	**33,256.0**	**20,146.4**	**19,840.8**	**19,833.9**	**9,057.3**	**8,894.9**	**8,887.8**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 2-5
North Coast Hydrologic Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

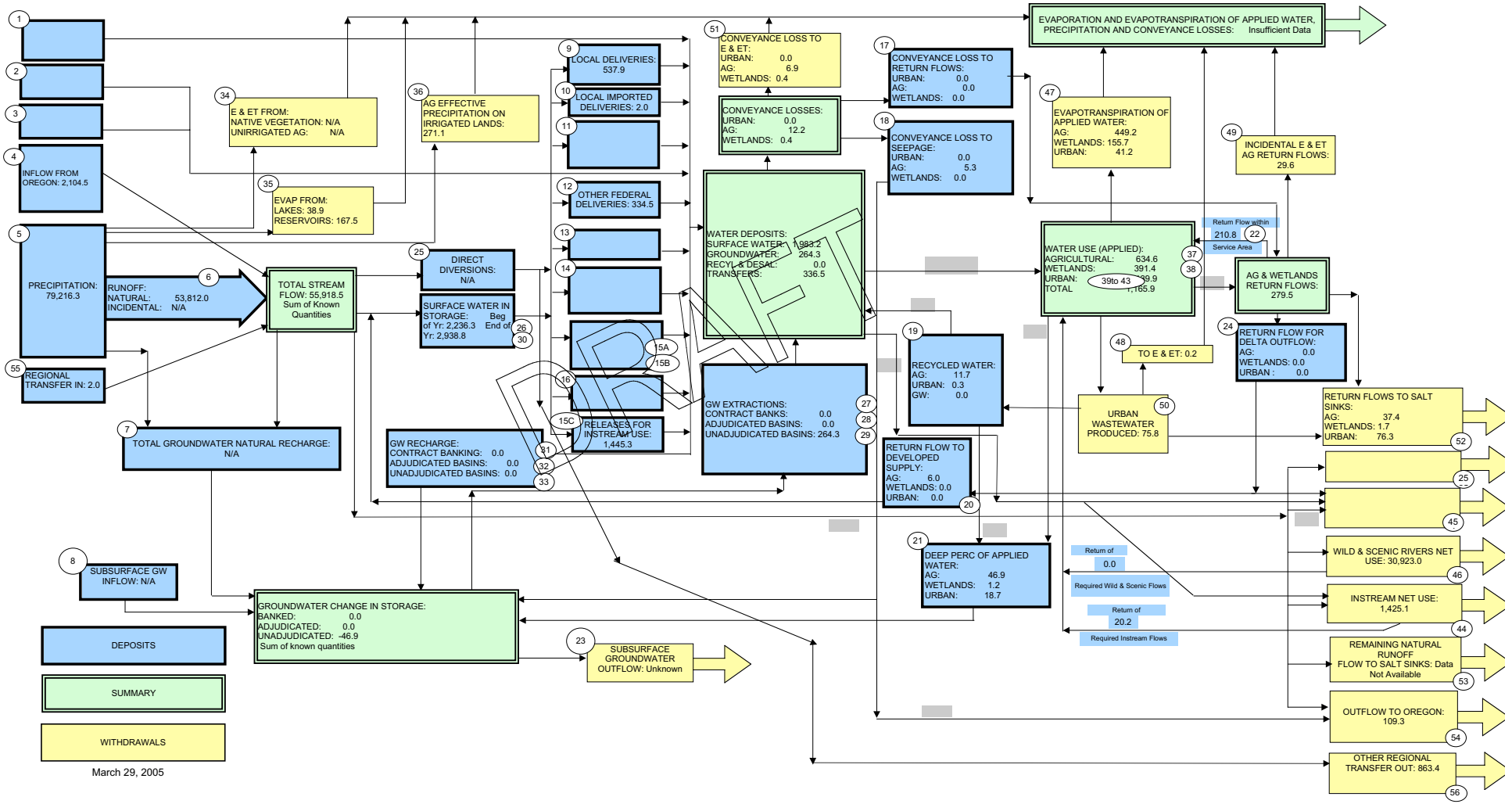

Figure 2-6
North Coast Hydrologic Region 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

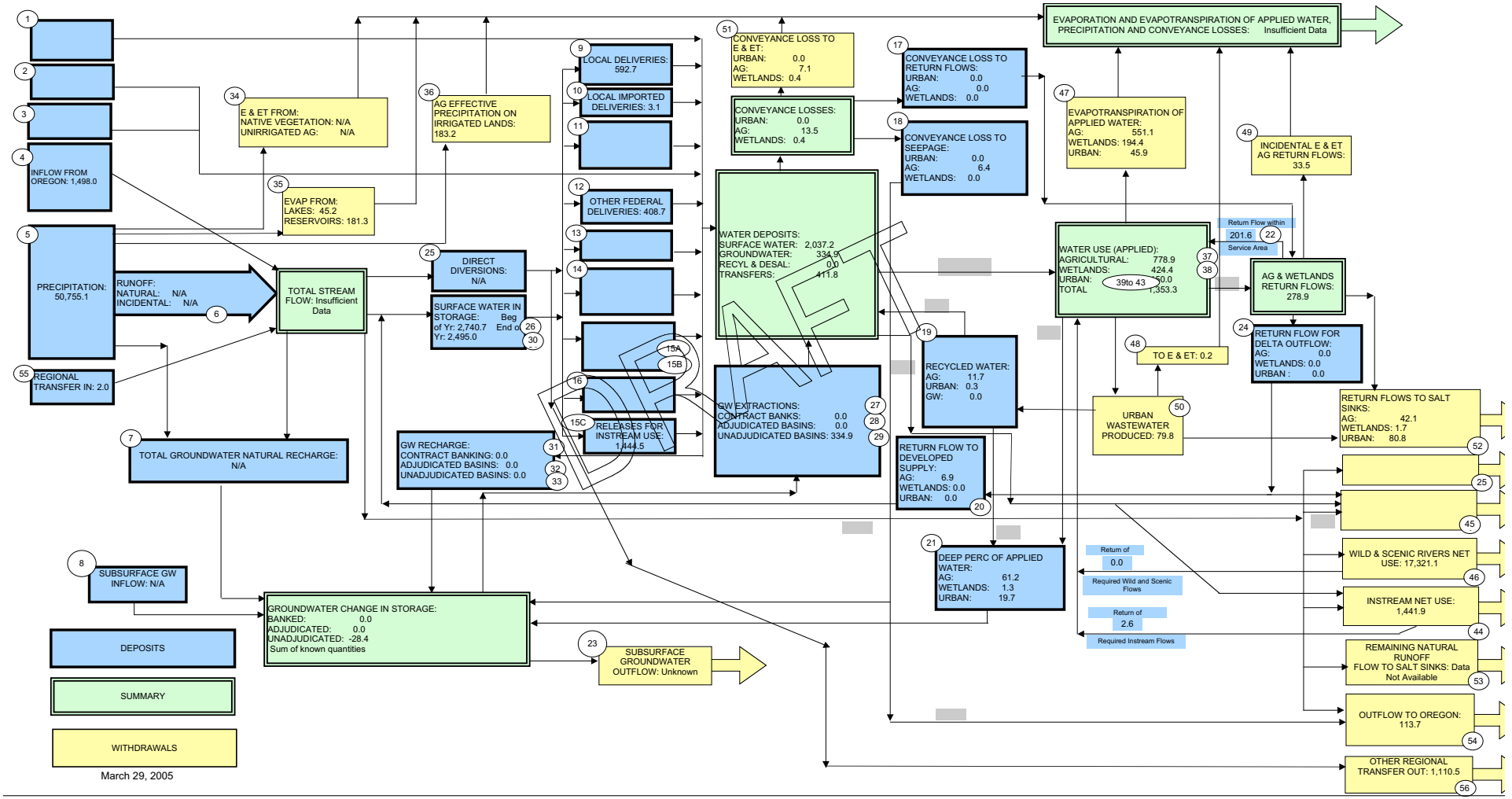

Figure 2-7
North Coast Hydrologic Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)